MISCELLANEOUS PUBLICATIONS

OF THE

BUREAU OF STANDARDS

Nos. 71-78

FIG. 1.—*The compressibility factors for air*

DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
George K. Burgess, Director

MISCELLANEOUS PUBLICATION OF THE
BUREAU OF STANDARDS
No. 71
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COMPRESSIBILITIES OF GASES[1]

Graphs for Computing the Compressibilities of Air, Argon, Helium, Hydrogen, Methane, Neon, Nitrogen, and Oxygen, and for Computing the Volumes Delivered from Cylinders Containing Argon, Helium, Hydrogen, Nitrogen, and Oxygen at High Pressures

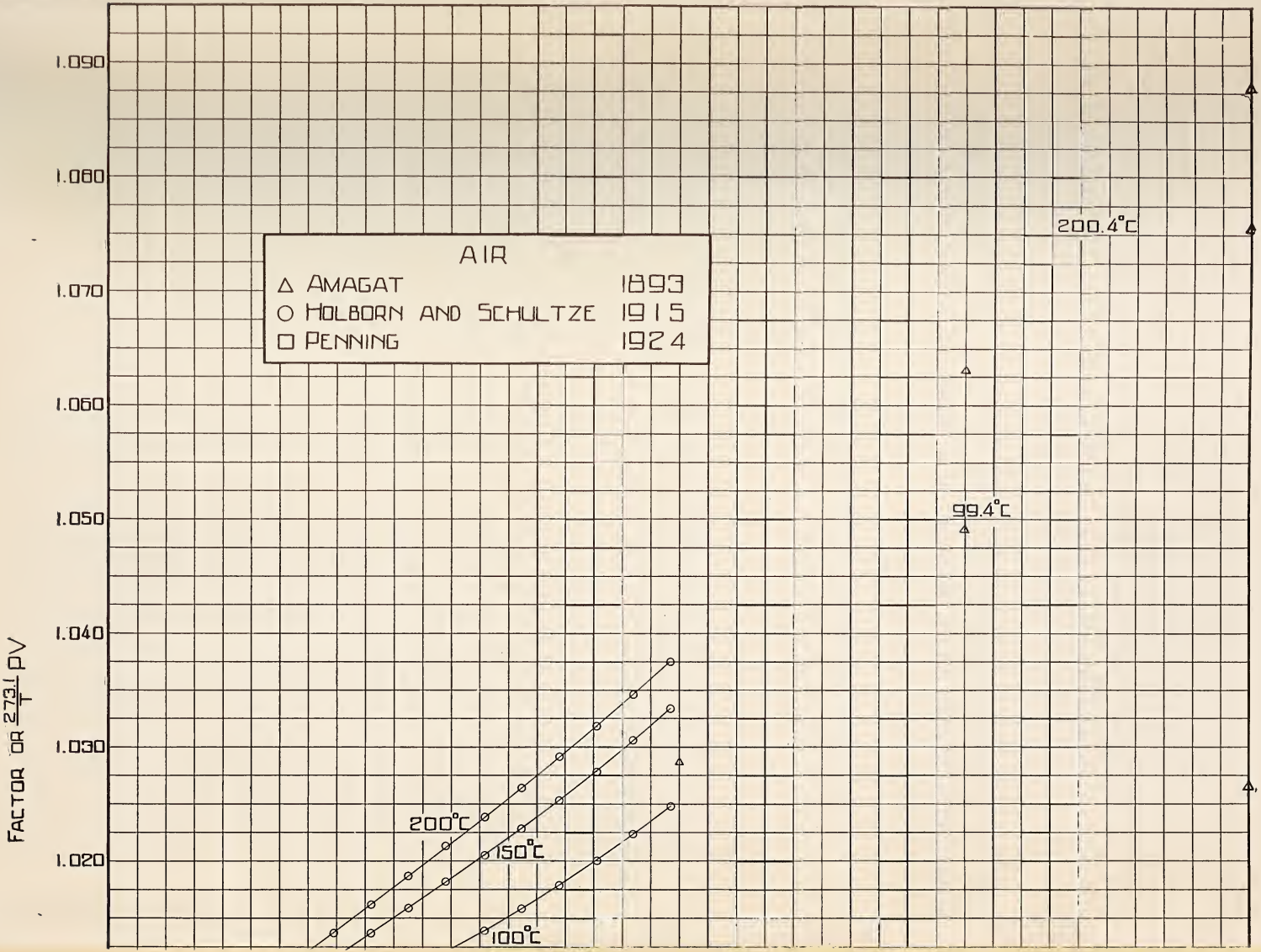
The following graphs from Circular No. 279, The Relations Between the Temperatures, Pressures, and Densities of Gases, have been reproduced on a larger scale in order that they may be used for obtaining numerical values. The graphs showing the factors for computing the compressibilities of gases up to pressures of 200 atmospheres contain nearly all of the published data covering this range of temperature and pressure, and the curves are drawn according to what appear to be the most probable values. The graphs indicating the volume of gas delivered from a cylinder containing the gas at high pressure have been computed for cylinders having a volume of 1.528 cubic feet, which is the volume of the so-called "200-foot" cylinder. For a cylinder of any other capacity the volume delivered would be proportional to the volume of the cylinder. In other words, the figure obtained from the graph should be multiplied by $\frac{V}{1.528}$, where V is the volume (in cubic feet) of the cylinder in question.

CONTENTS

	Page
Graphs 1 to 8. Values of the factor $\frac{273.1}{T}pv$ plotted against the pressure, where T is the absolute temperature (°C.), p the pressure in atmospheres, and v the volume, which is unity at 0° C. and 1 atmosphere of pressure	2–9
Graph 1. Air	2
Graph 2. Argon	3
Graph 3. Helium	4
Graph 4. Hydrogen	5
Graph 5. Methane	6
Graph 6. Neon	7
Graph 7. Nitrogen	8
Graph 8. Oxygen	9
Graphs 9 to 13. Volume (measured at 68° F. and 1 atmosphere) of gas delivered from a cylinder containing the gas at high pressure	10–14
Graph 9. Argon	10
Graph 10. Helium	11
Graph 11. Hydrogen	12
Graph 12. Nitrogen	13
Graph 13. Oxygen	14

[1] Prepared by S. F. Pickering, Associate Chemist.

66339°—25†


AIR
△ AMAGAT 1893
○ HOLBORN AND SCHULTZE 1915
□ PENNING 1924
200.4°C
99.4°C
200°C
150°C
100°C
1.090
1.080
1.070
1.060
1.050
1.040
1.030
1.020
FACTOR OR 273/T PV

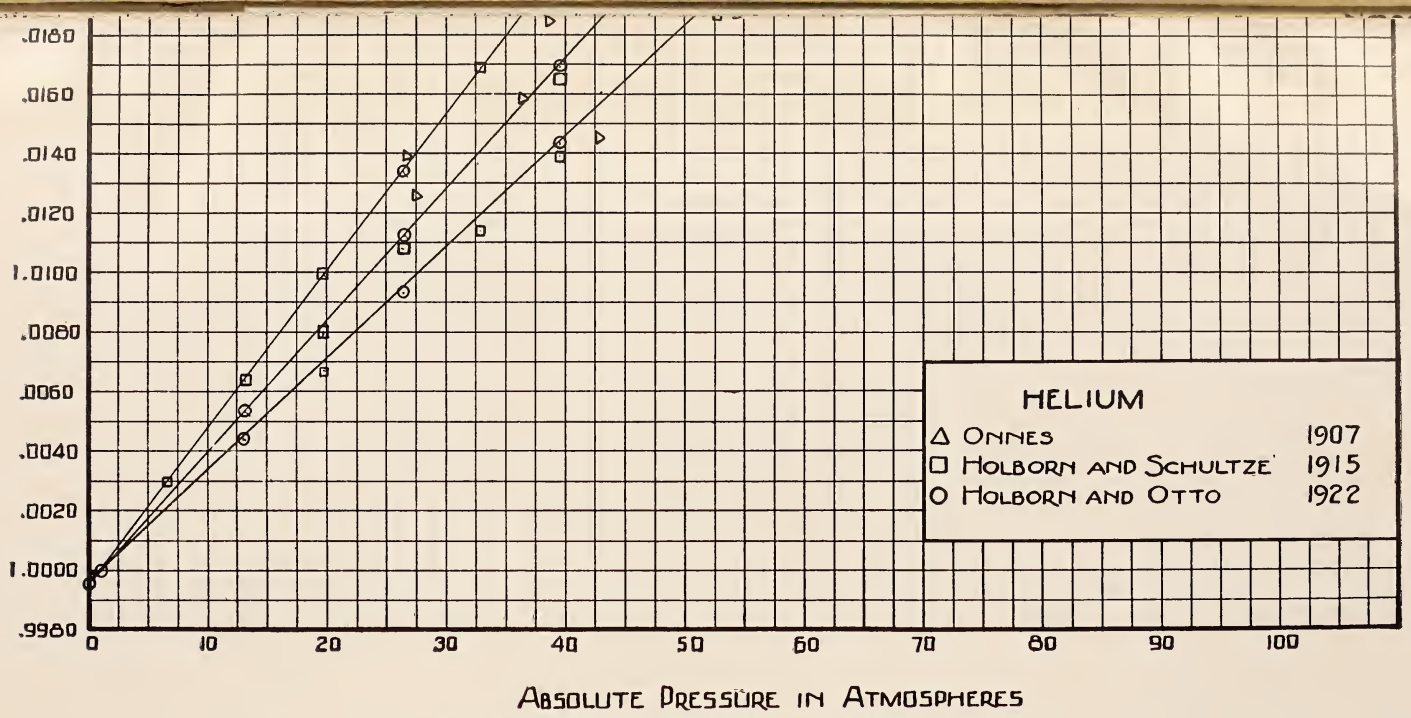
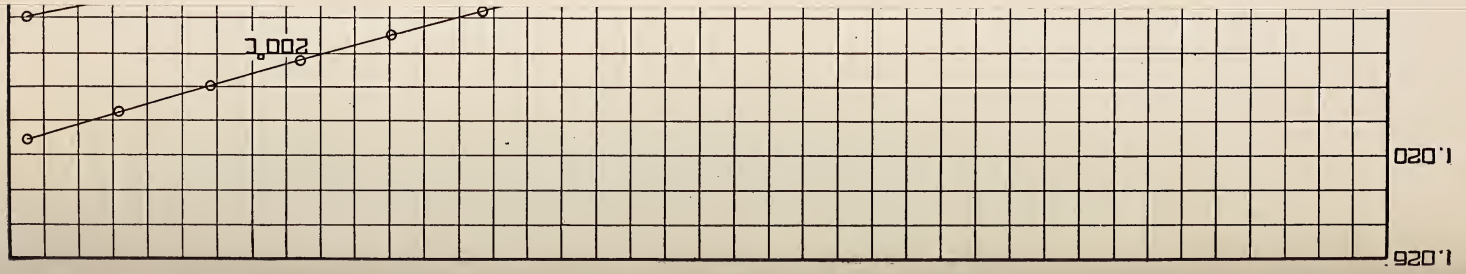


FIG. 3.—*The compressibility factors for helium*



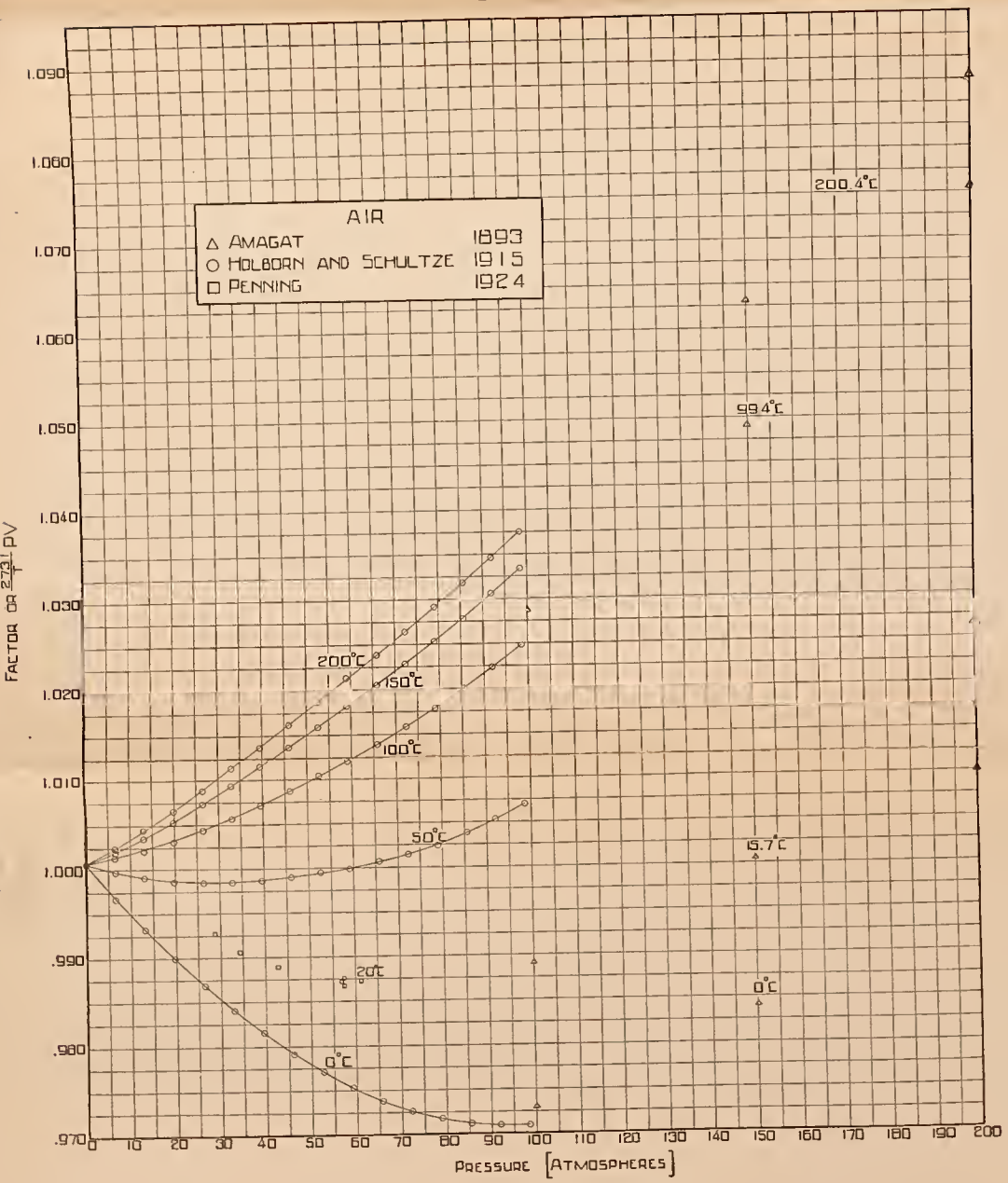


FIG. 1.—*The compressibility factors for air*

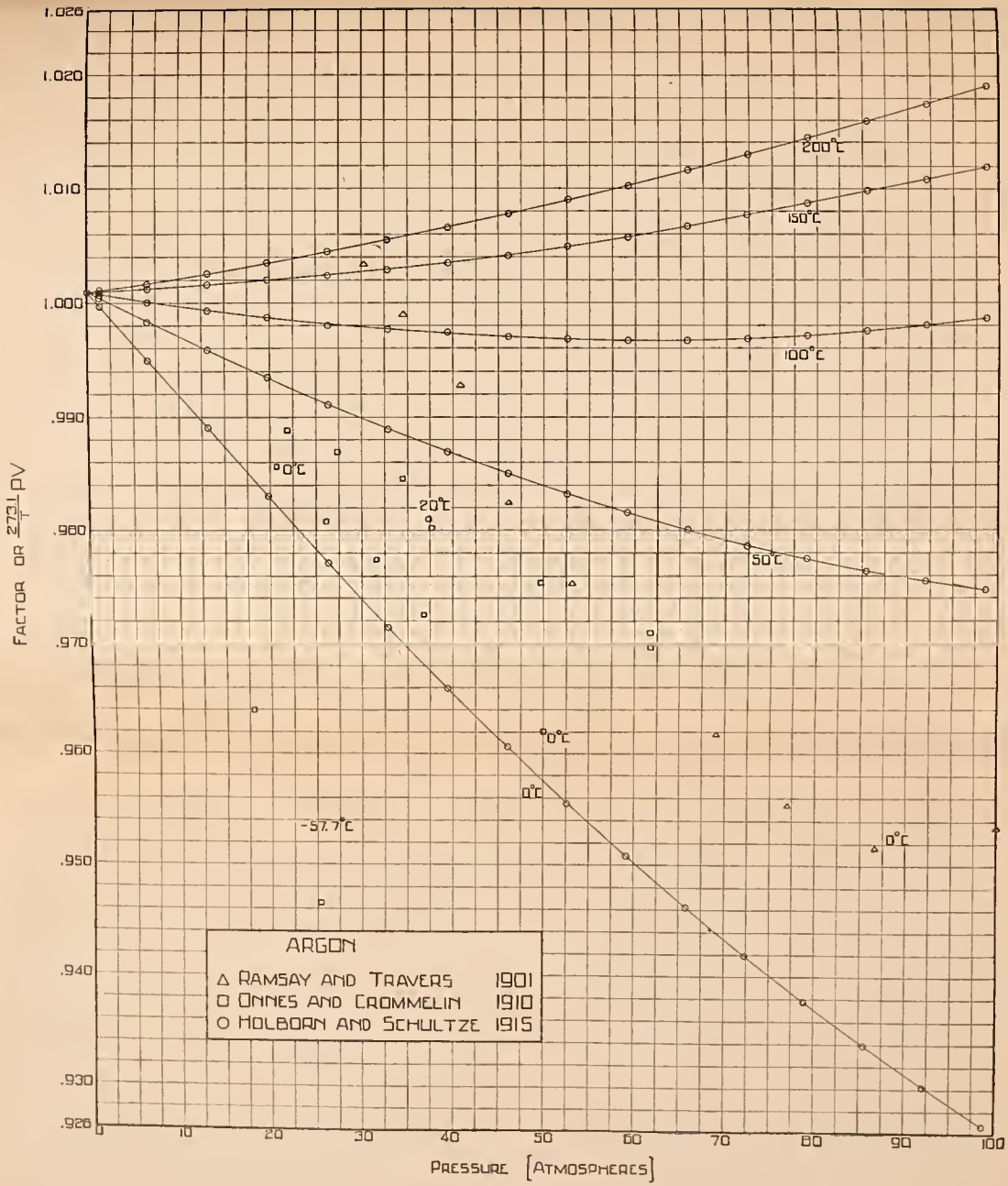
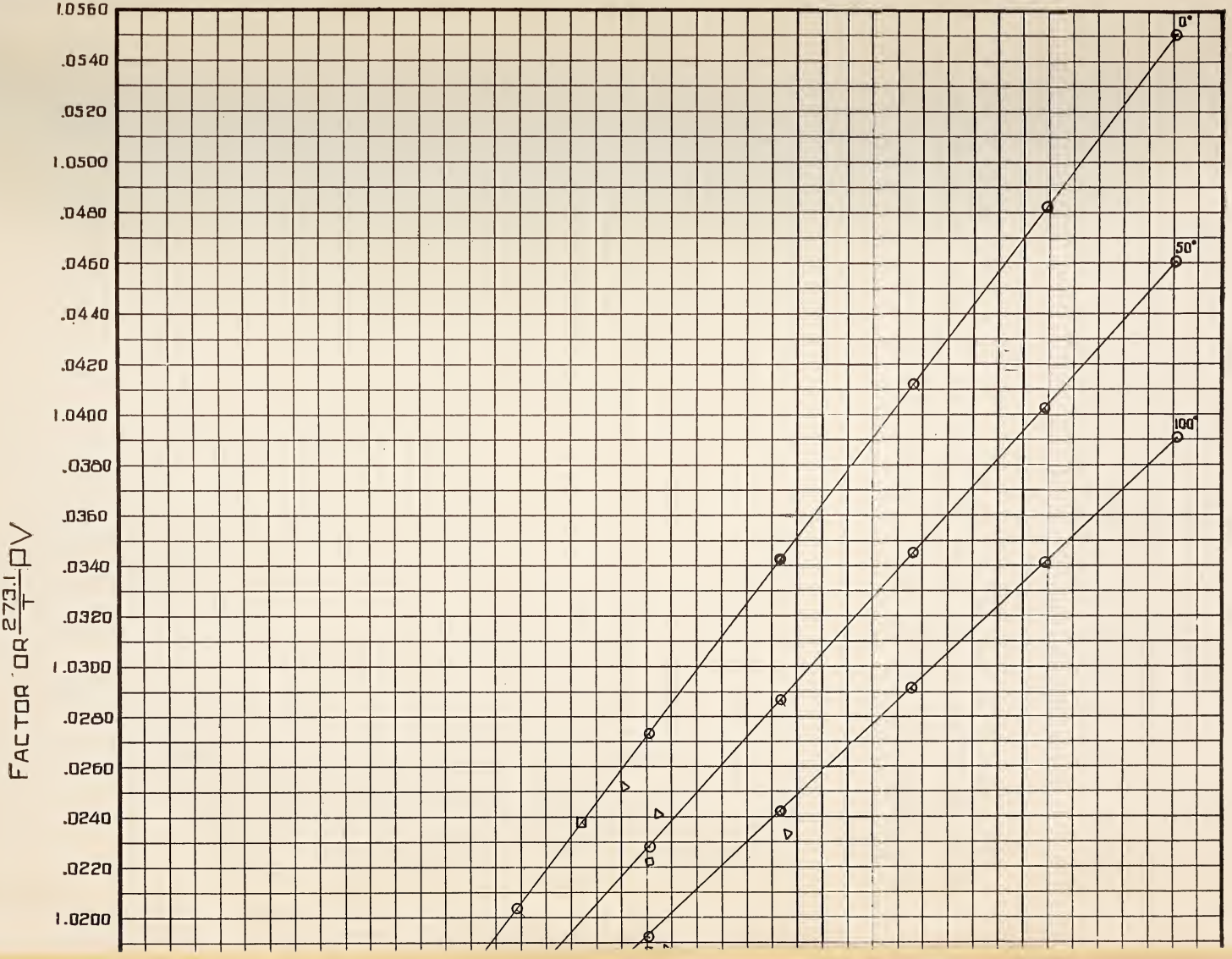


FIG. 2.—*The compressibility factors for argon.*


1.0560
.0540
.0520
1.0500
.0480
.0460
.0440
.0420
1.0400
.0380
.0360
.0340
.0320
1.0300
.0280
.0260
.0240
.0220
1.0200
0°
50°
100°
FACTOR OR $\frac{273.1}{T}PV$

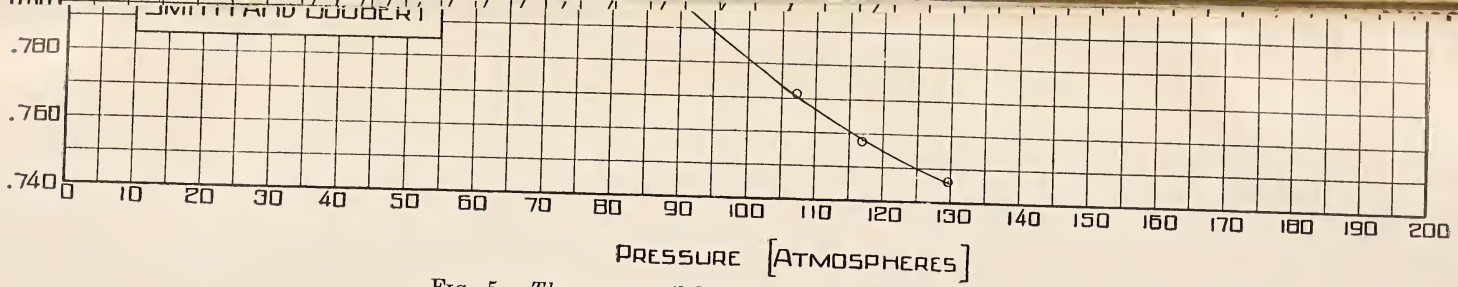
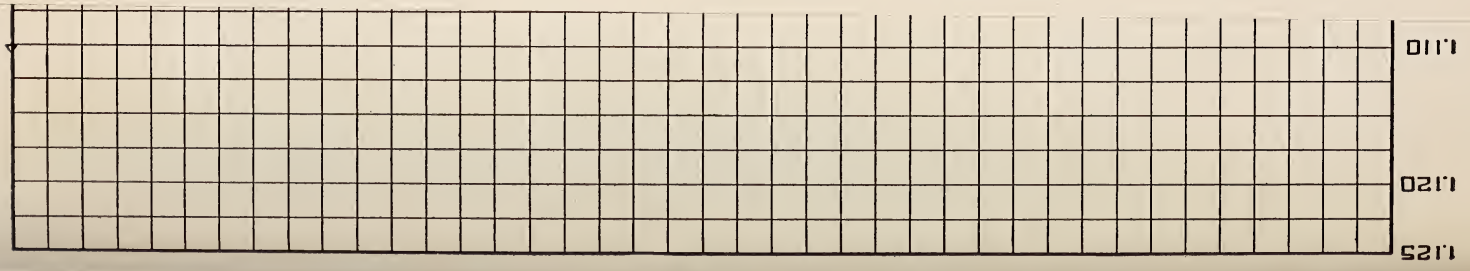


FIG. 5.—*The compressibility factors for methane*



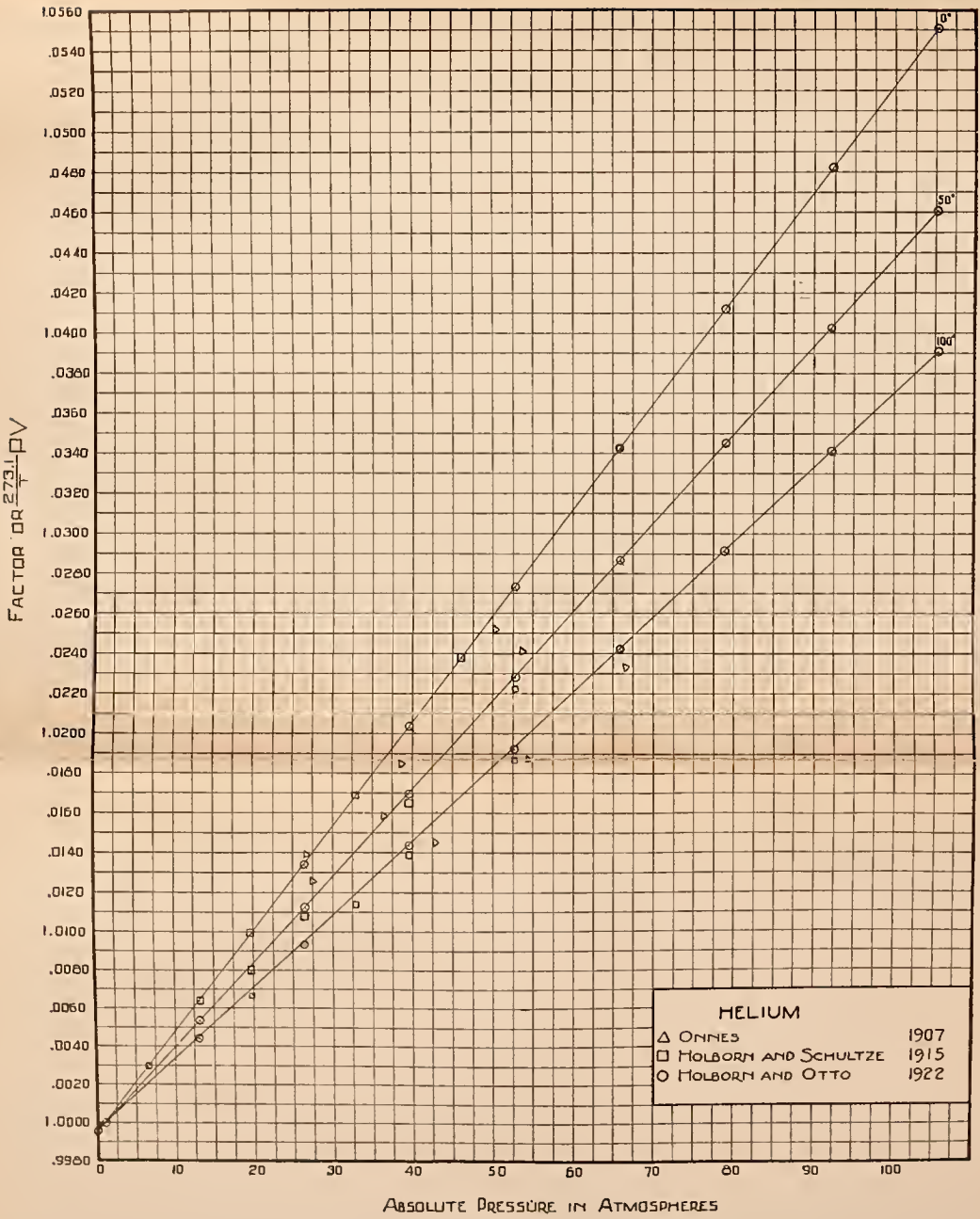


FIG. 3.—*The compressibility factors for helium*

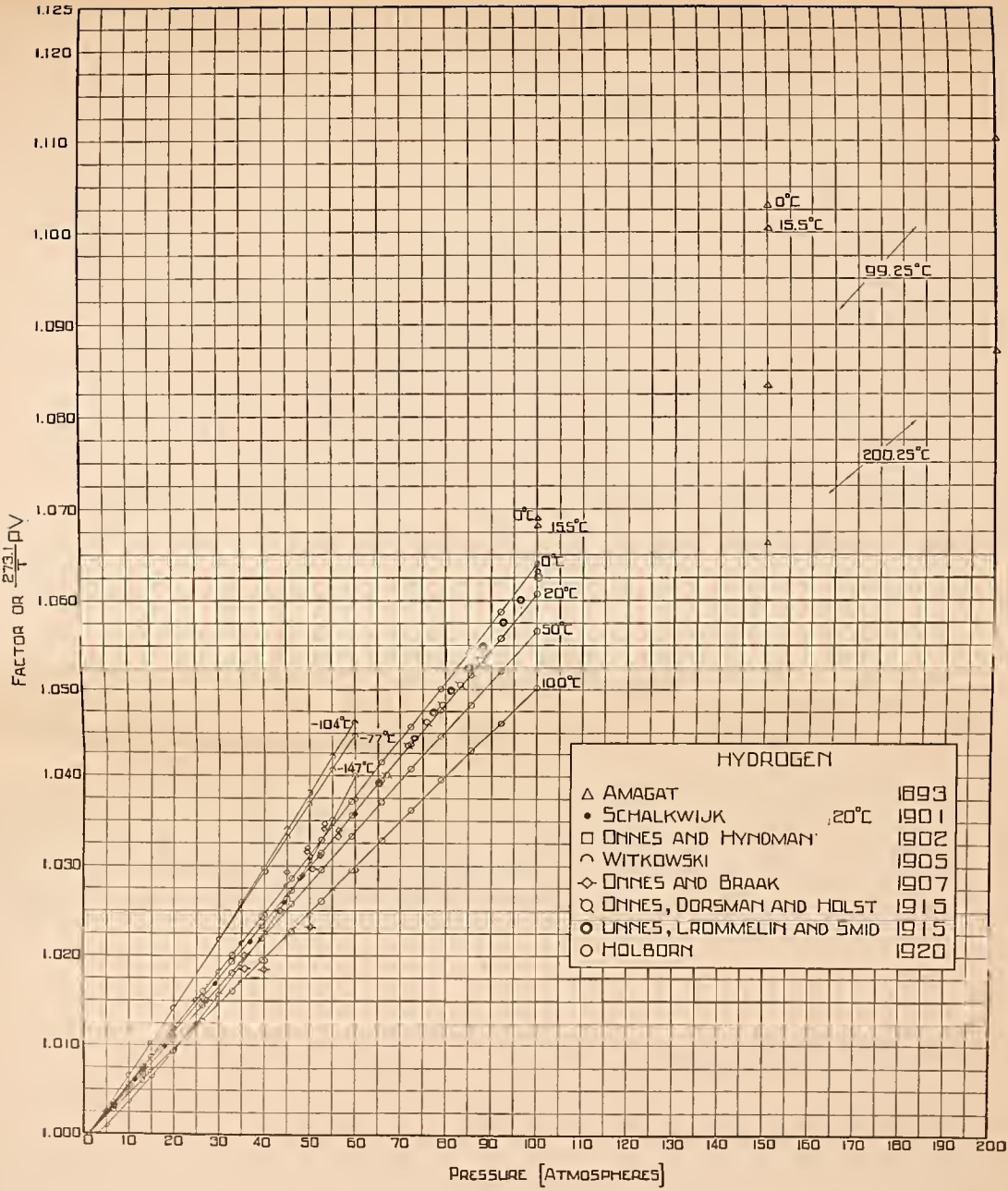
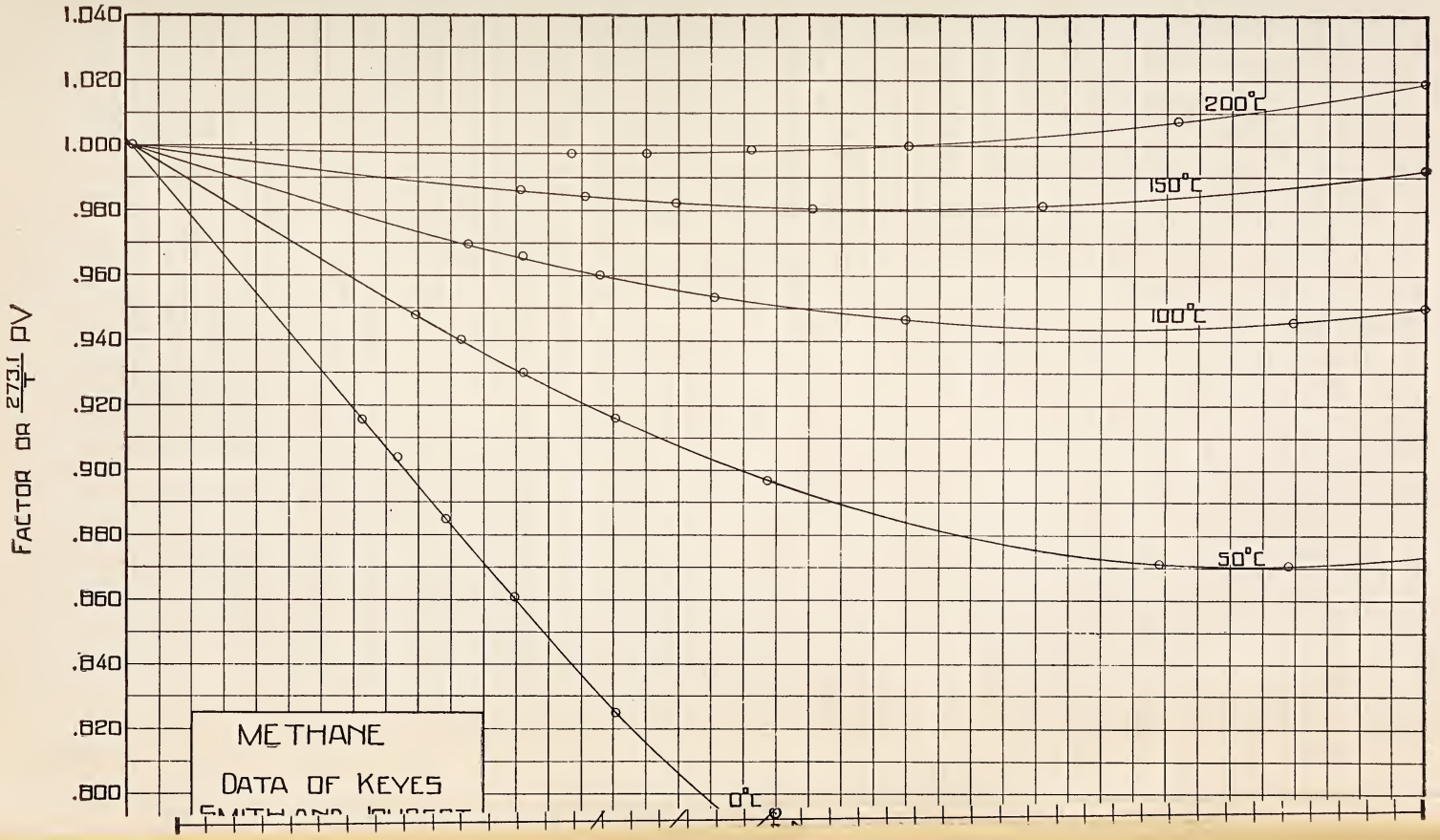


FIG. 4.—*The compressibility factors for hydrogen*


1.040
1.020
1.000
.980
.960
.940
.920
.900
.880
.860
.840
.820
.800
FACTOR OR $\frac{273.1}{T}$ PV
200°C
150°C
100°C
50°C
0°C
METHANE
DATA OF KEYES
SMITH AND BURGET

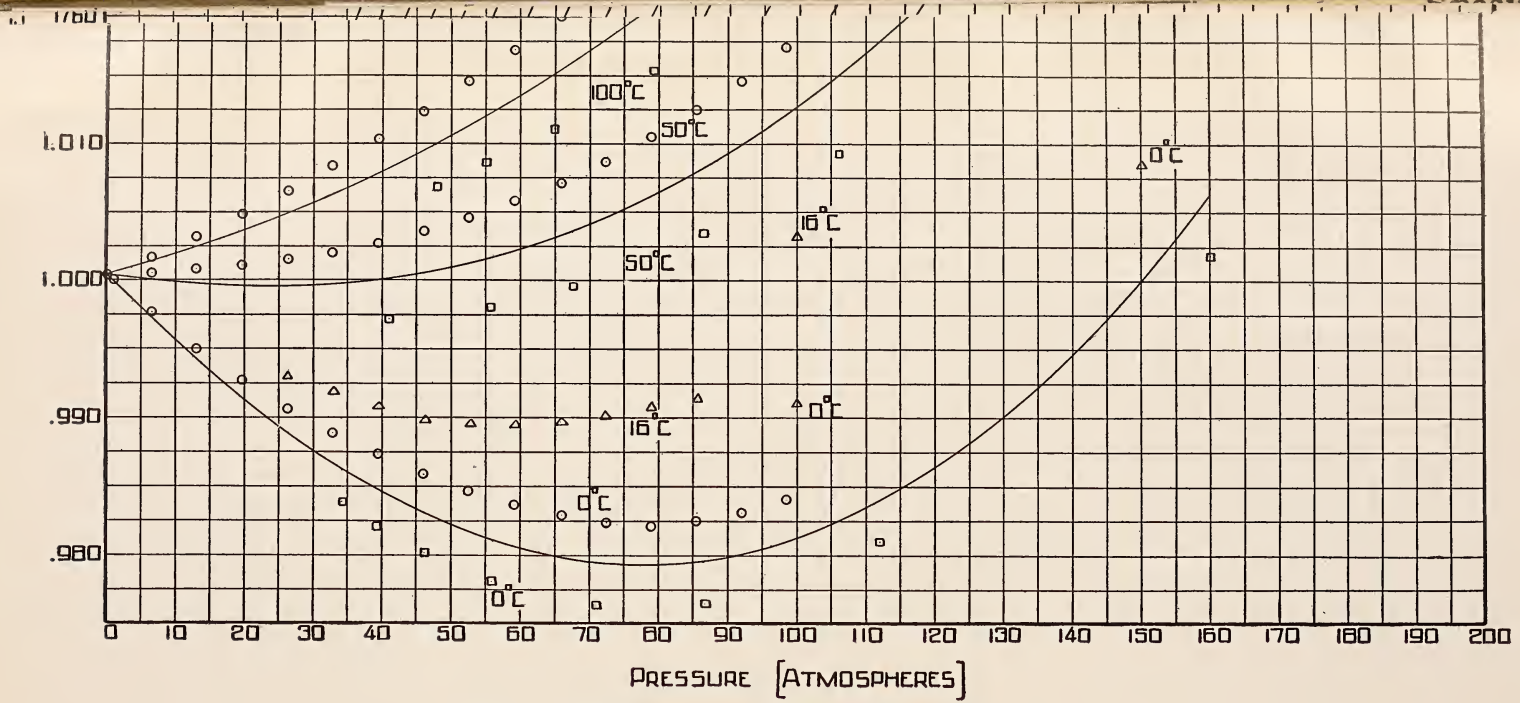
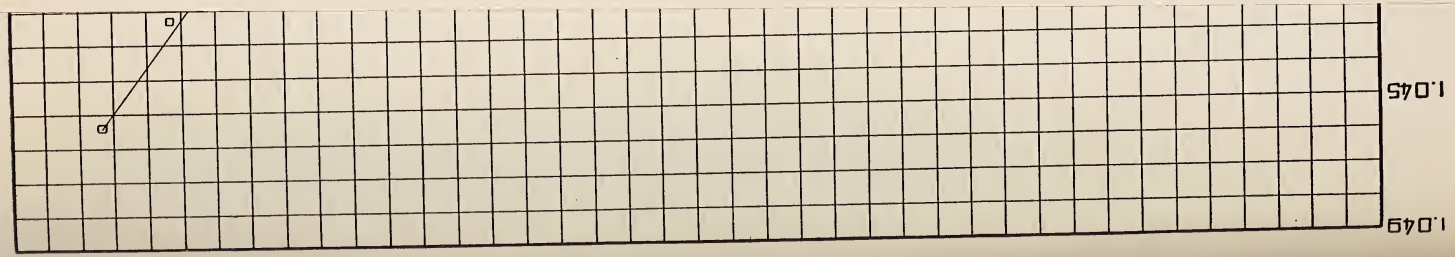


FIG. 7.—*The compressibility factors for nitrogen*



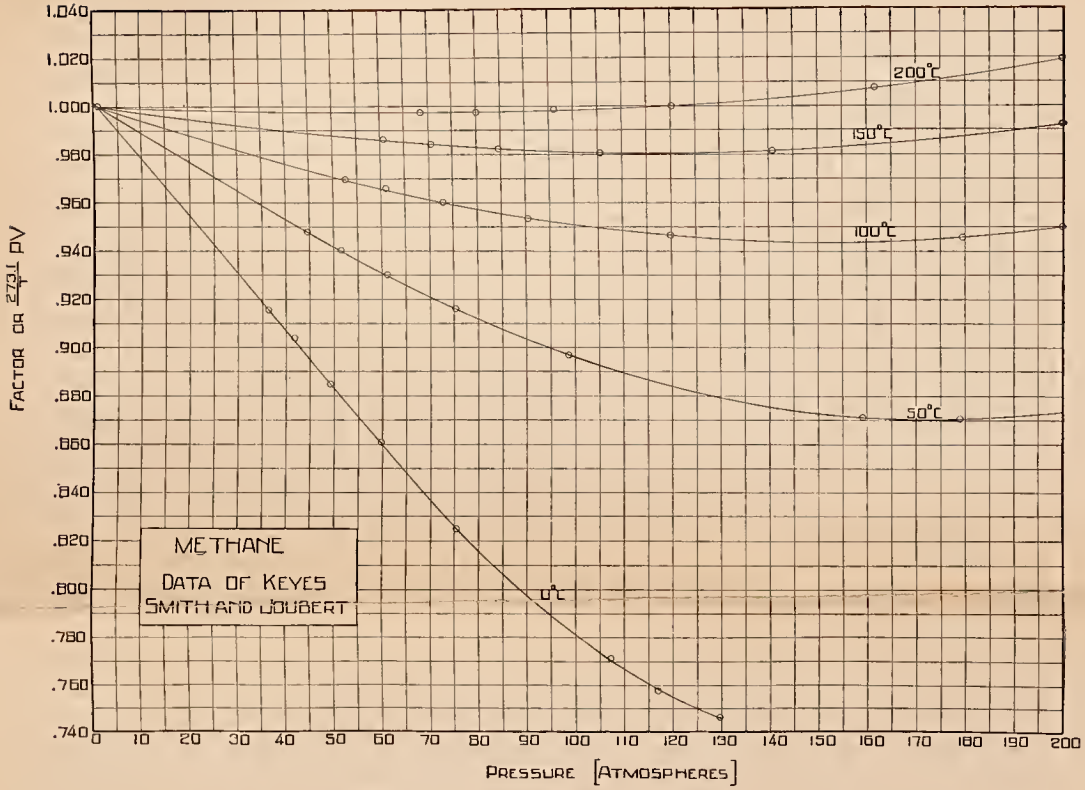


FIG. 5.—*The compressibility factors for methane*

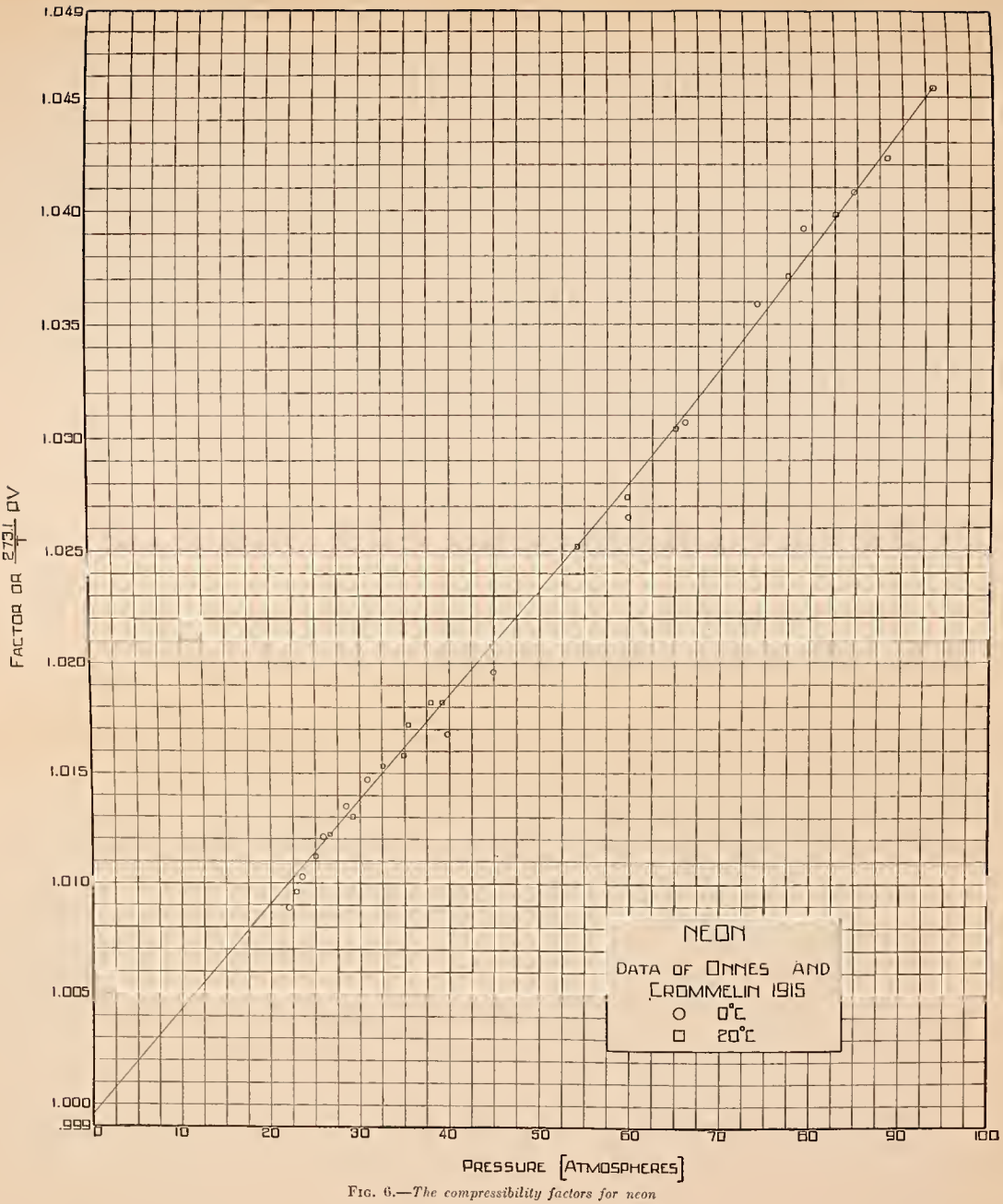
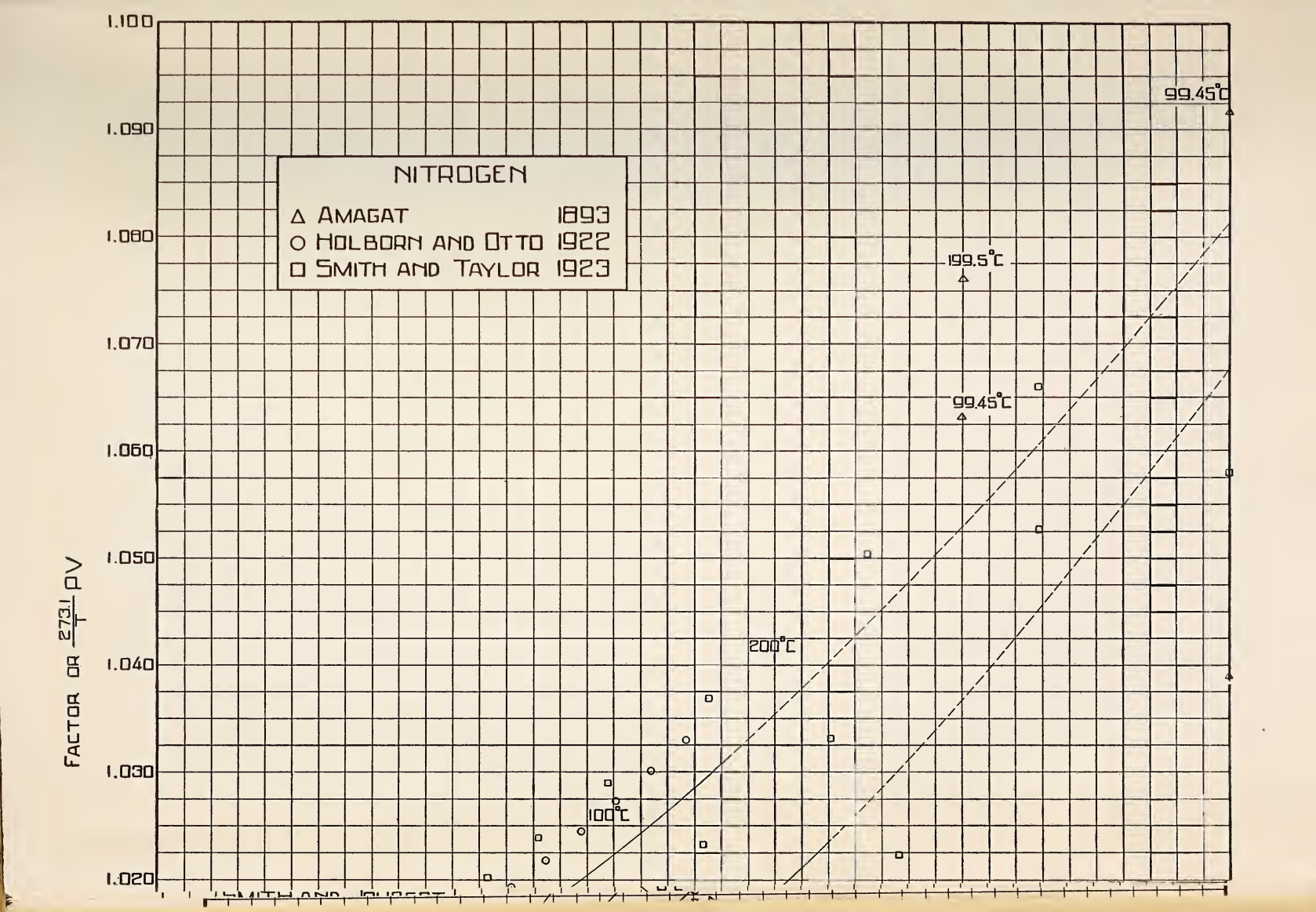


FIG. 6.—*The compressibility factors for neon*


NITROGEN
△ AMAGAT 1893
○ HOLBORN AND OTTO 1922
□ SMITH AND TAYLOR 1923
99.45°C
199.5°C
99.45°C
200°C
100°C
FACTOR OR $\frac{273.1}{T}$ PV
1.100
1.090
1.080
1.070
1.060
1.050
1.040
1.030
1.020

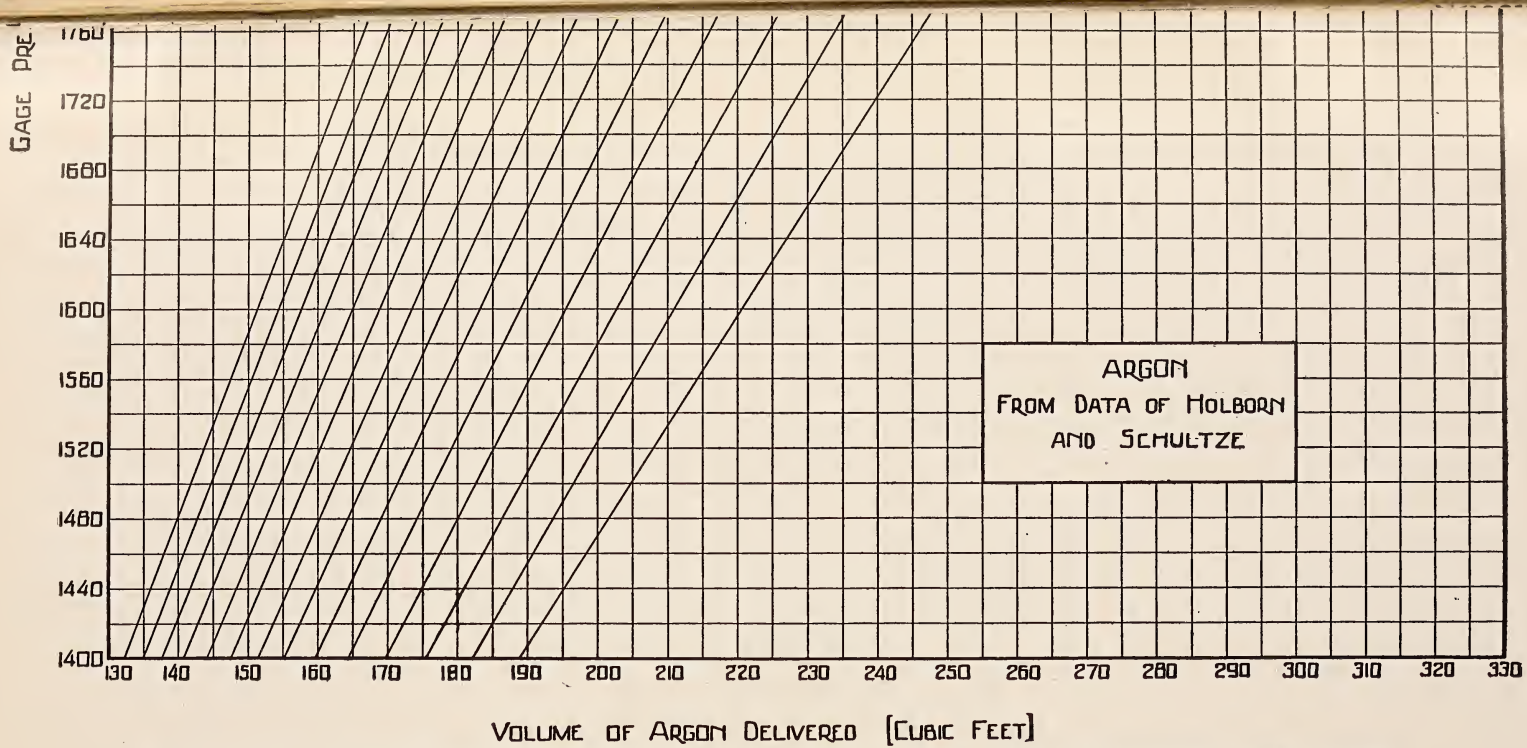
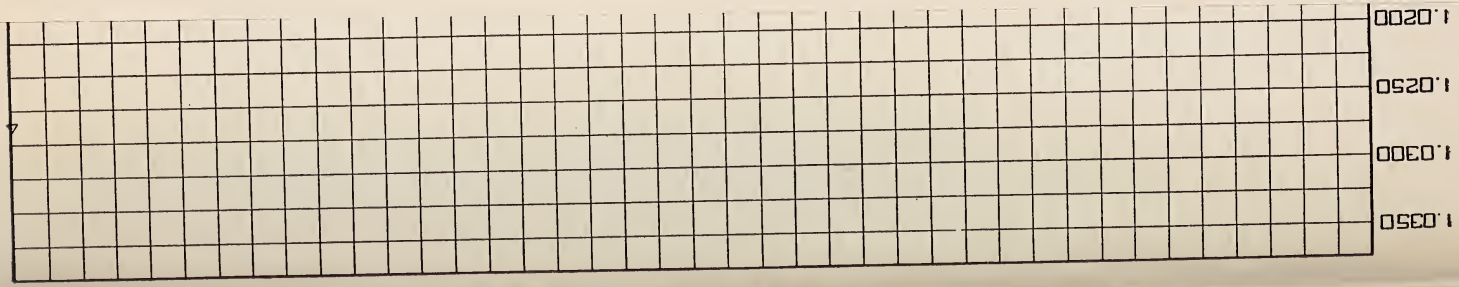


FIG. 9.—*Volume of argon (measured at 1 atmosphere and 68° F.) delivered from a cylinder whose volume is 1.528 cubic feet*



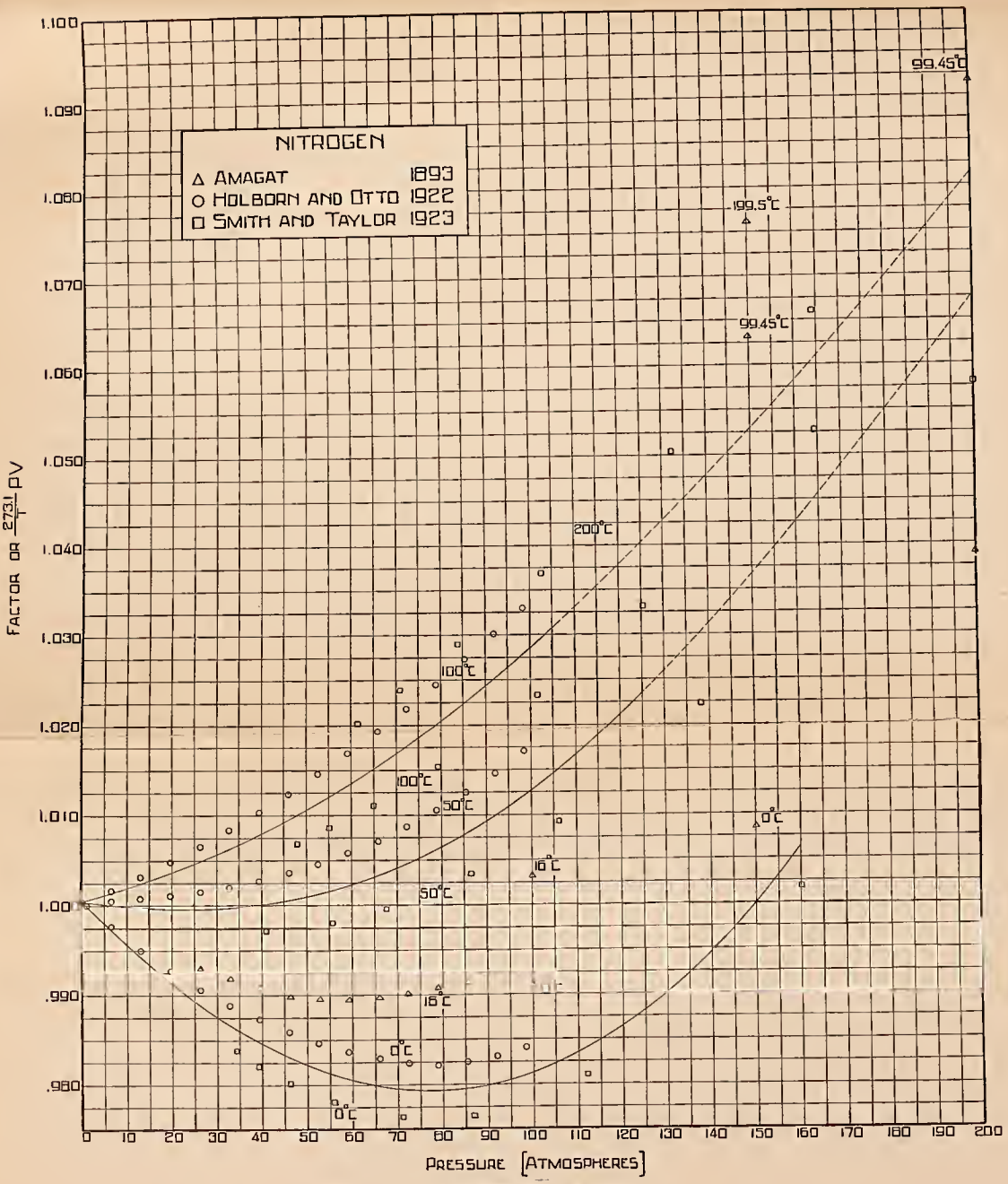


FIG. 7.—*The compressibility factors for nitrogen*

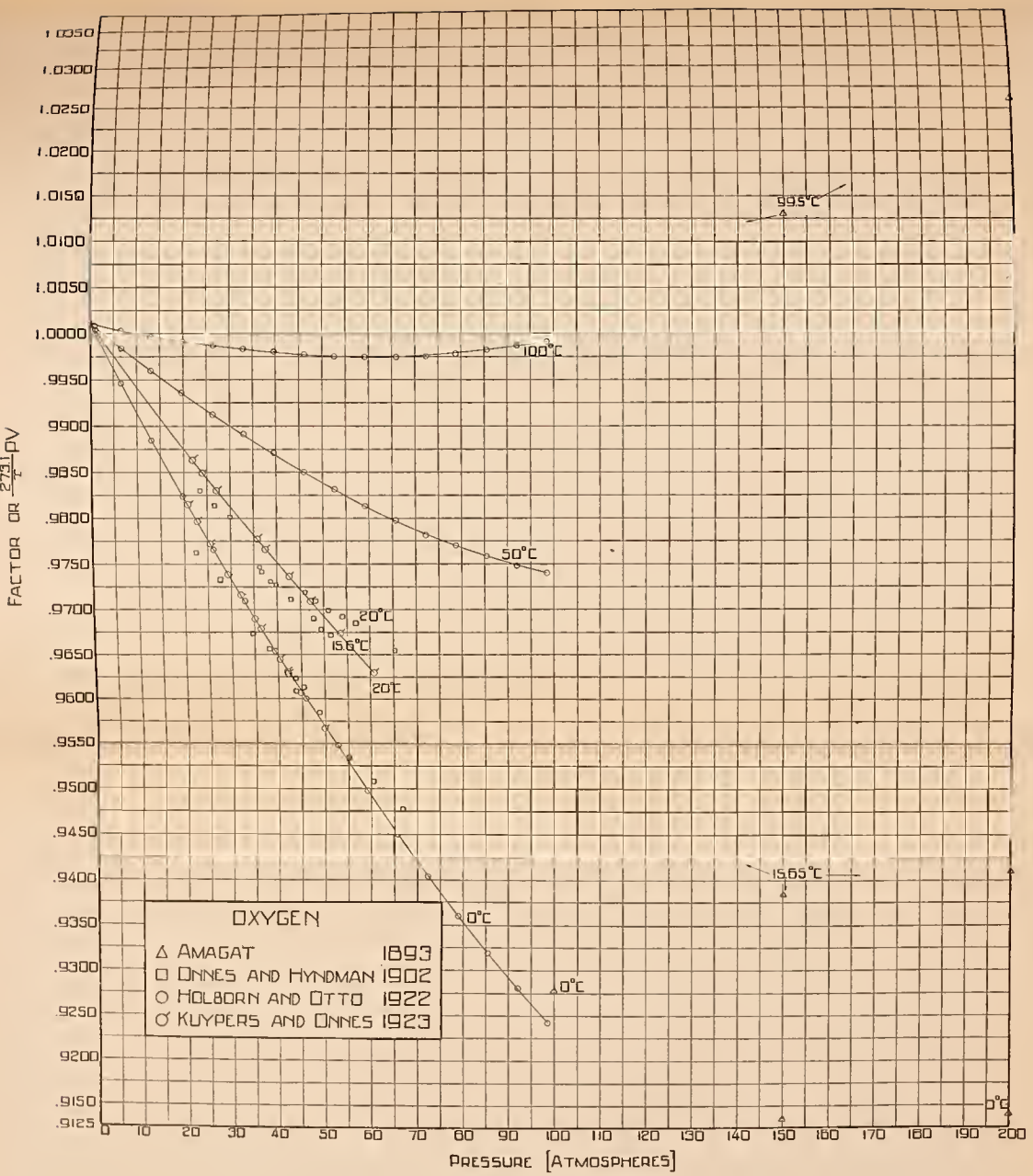
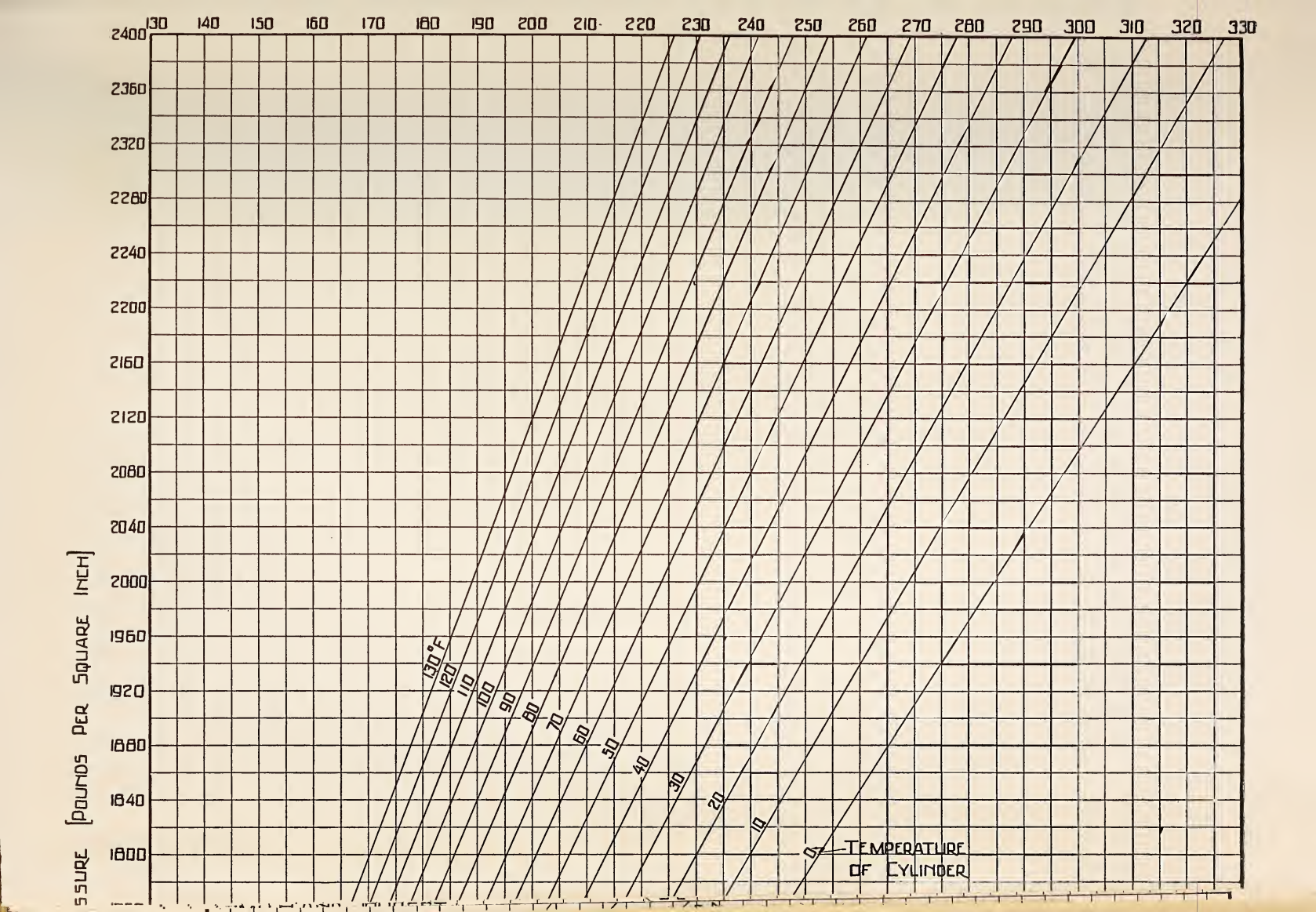


FIG. 8.—*The compressibility factors for oxygen*


130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330
2400 2360 2320 2280 2240 2200 2160 2120 2080 2040 2000 1960 1920 1880 1840 1800
ESSURE [POUNDS PER SQUARE INCH]
130°F
120
110
100
90
80
70
60
50
40
30
20
10
0
TEMPERATURE OF CYLINDER

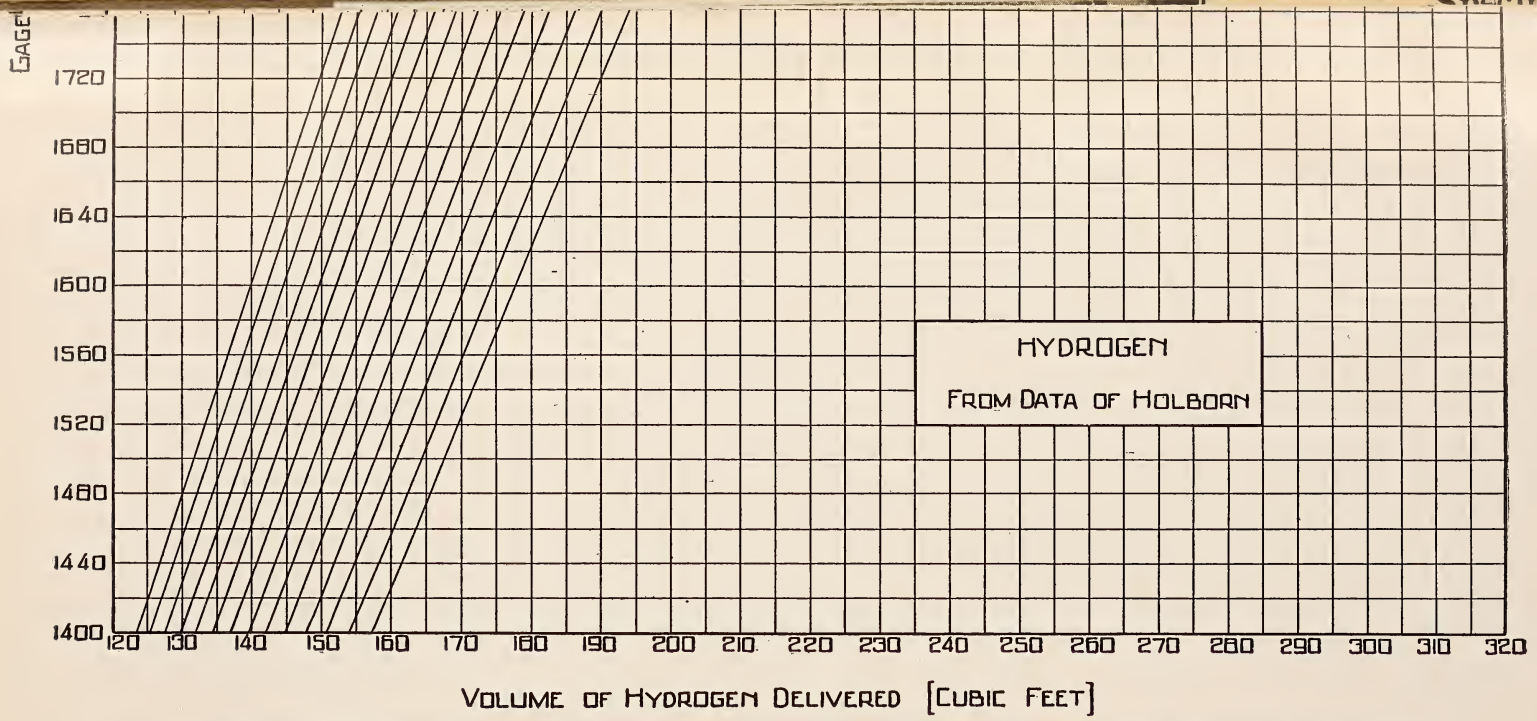
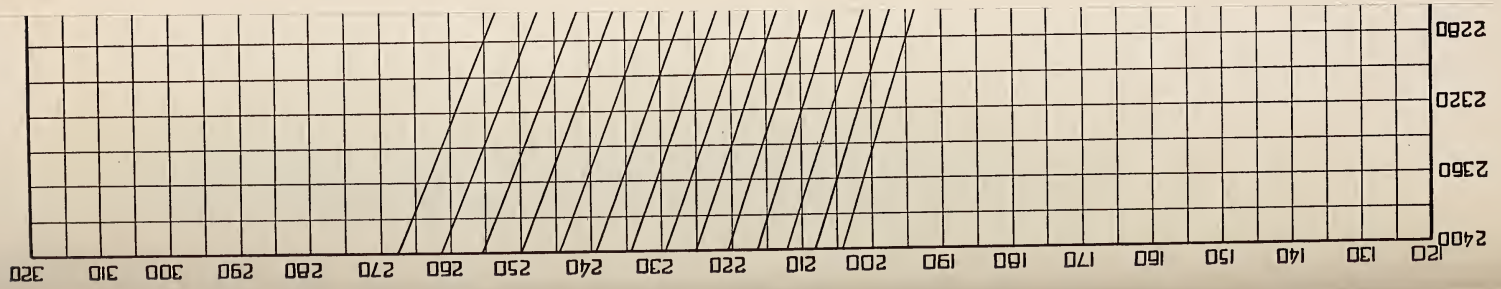
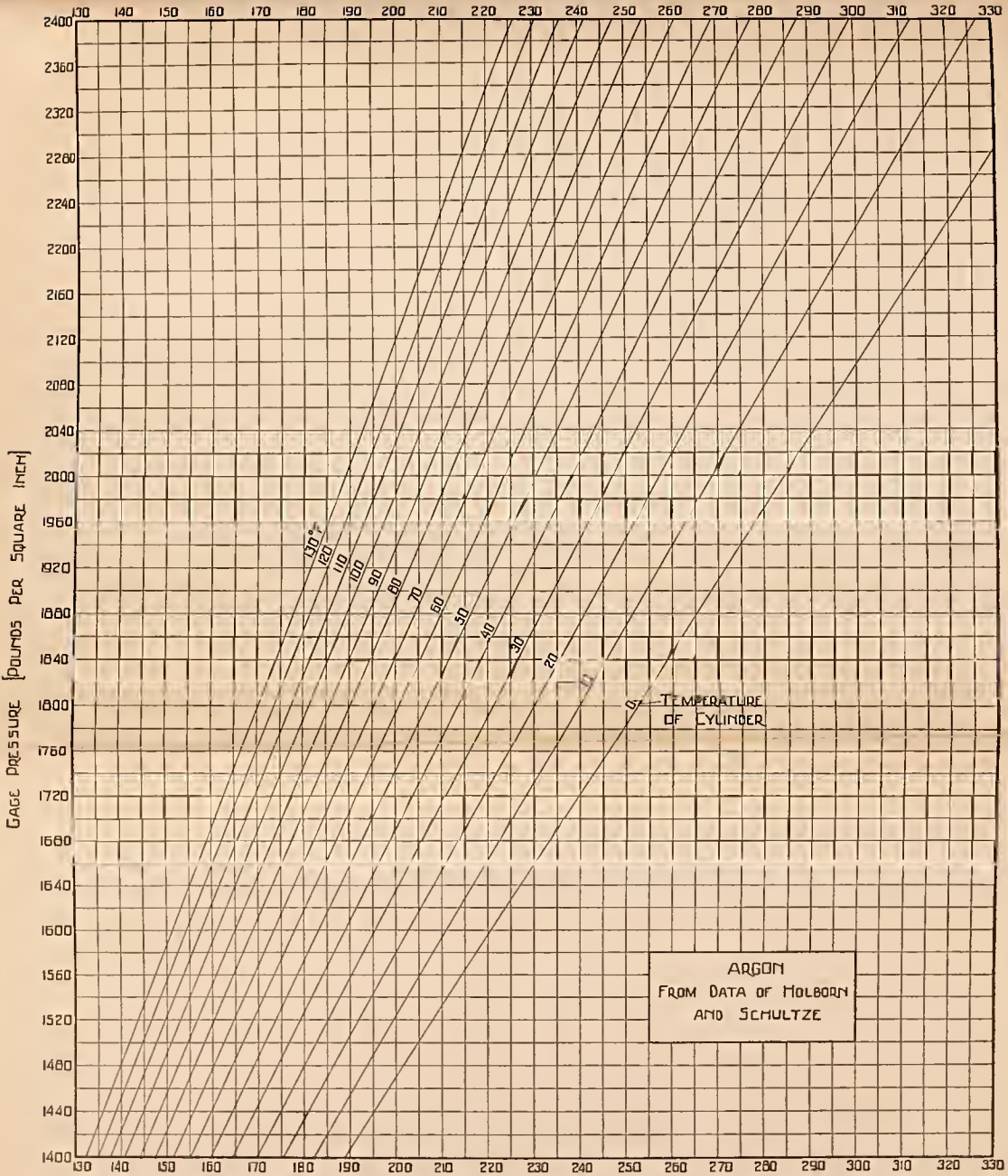


FIG. 11.—*Volume of hydrogen (measured at 1 atmosphere and 68° F.) delivered from a cylinder whose volume is 1.528 cubic feet*





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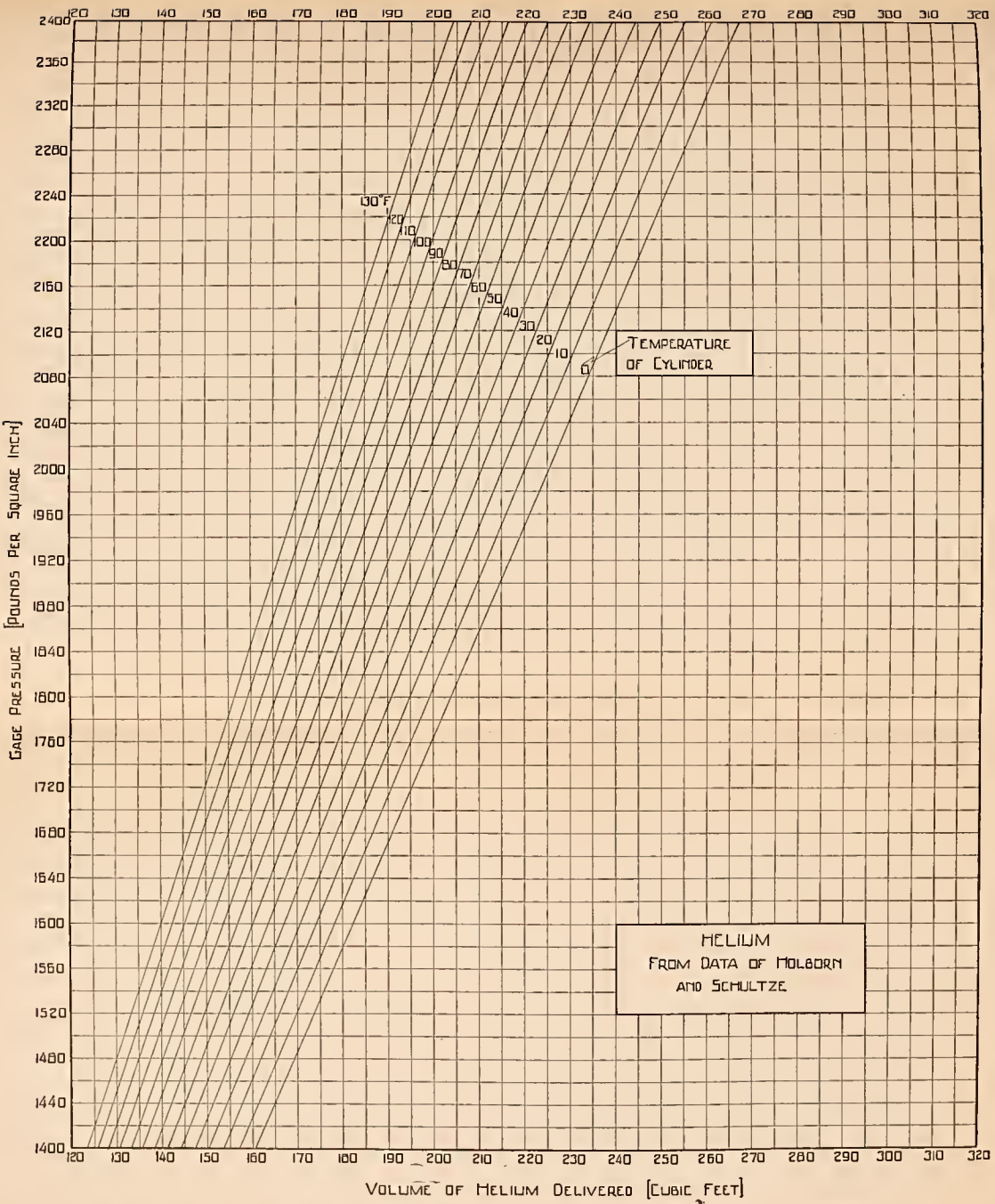
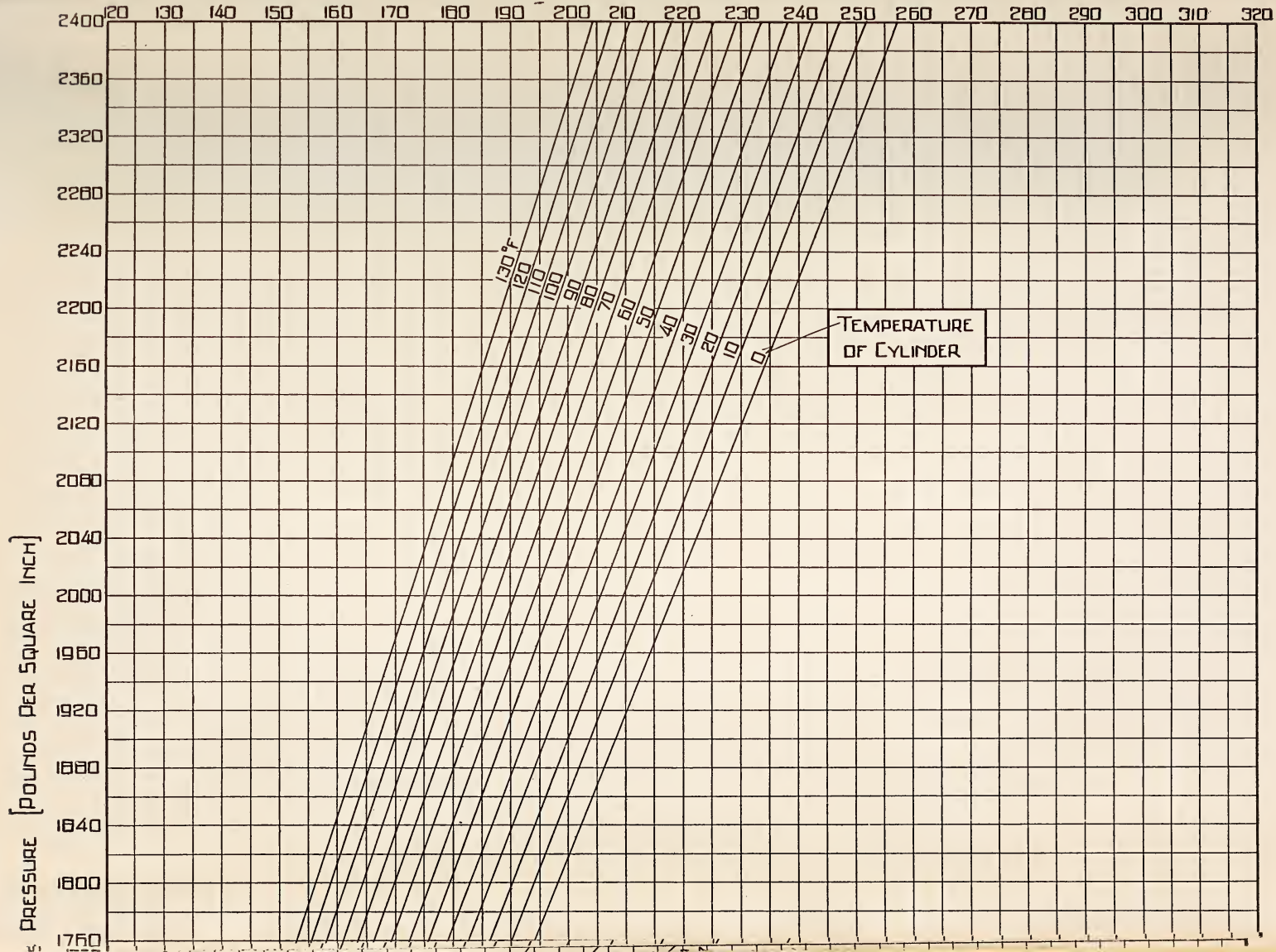


FIG. 10.—*Volume of helium (measured at 1 atmosphere and 68° F.) delivered from a cylinder whose volume is 1.528 cubic feet*


120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320
2400 2360 2320 2280 2240 2200 2160 2120 2080 2040 2000 1960 1920 1880 1840 1800 1760
130°F 120 110 100 90 80 70 60 50 40 30 20 10 0
TEMPERATURE OF CYLINDER
PRESSURE [POUNDS PER SQUARE INCH]

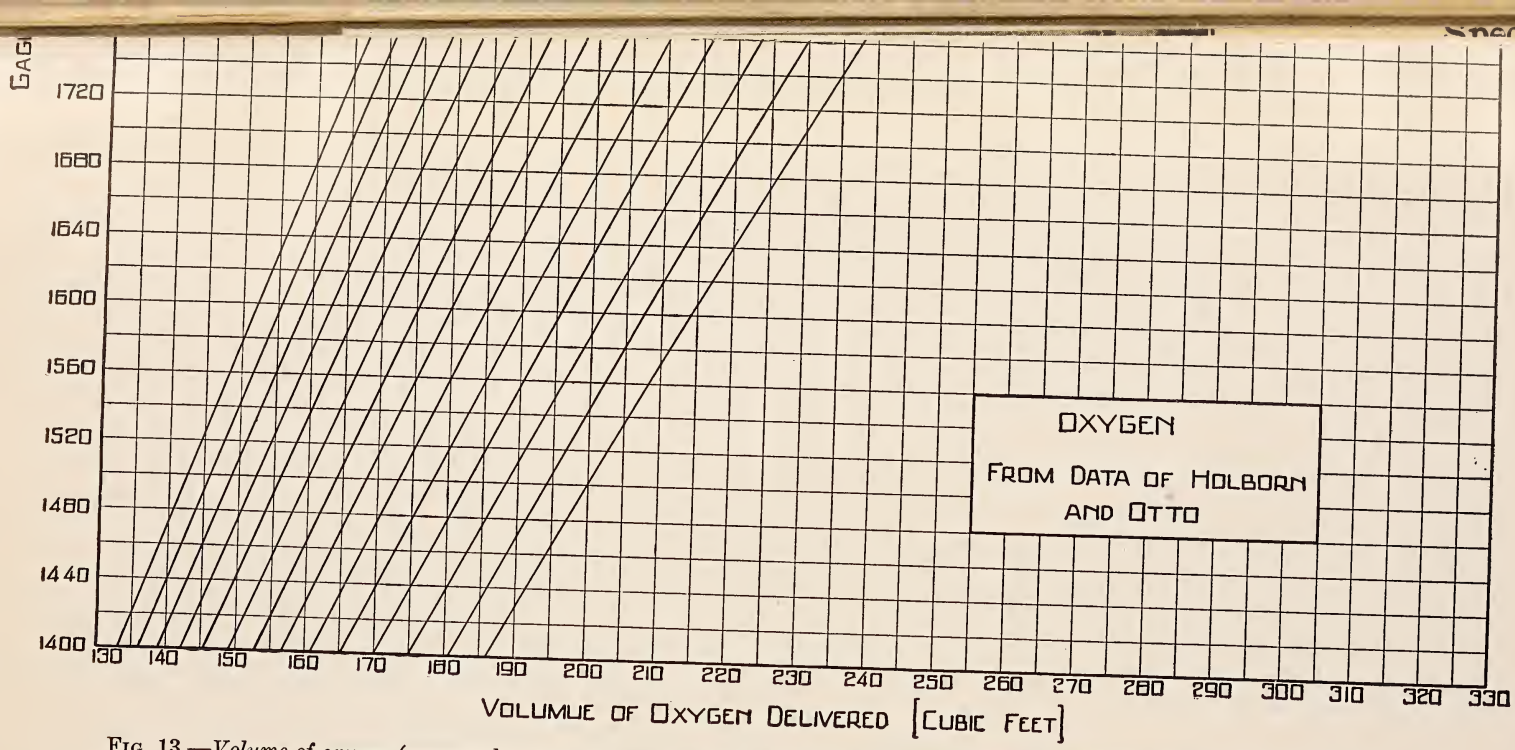
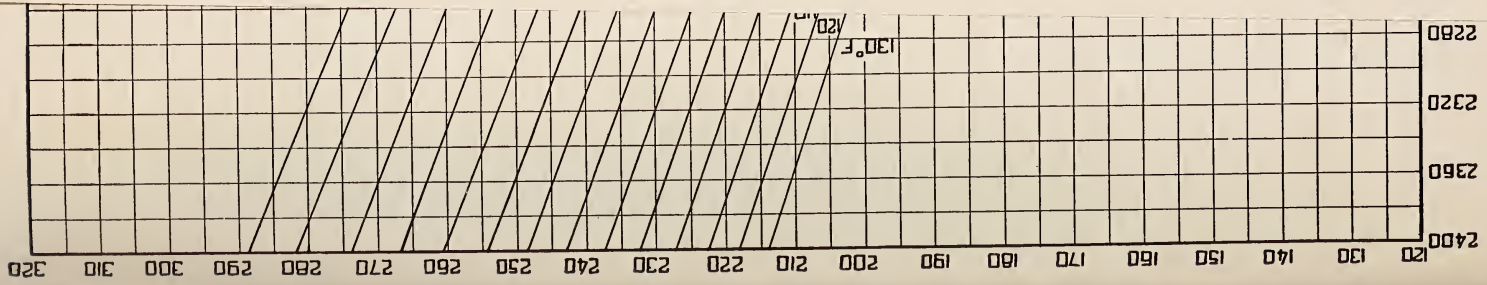


FIG. 13.—*Volume of oxygen (measured at 1 atmosphere and 68° F.) delivered from a cylinder whose volume is 1.528 cubic feet*



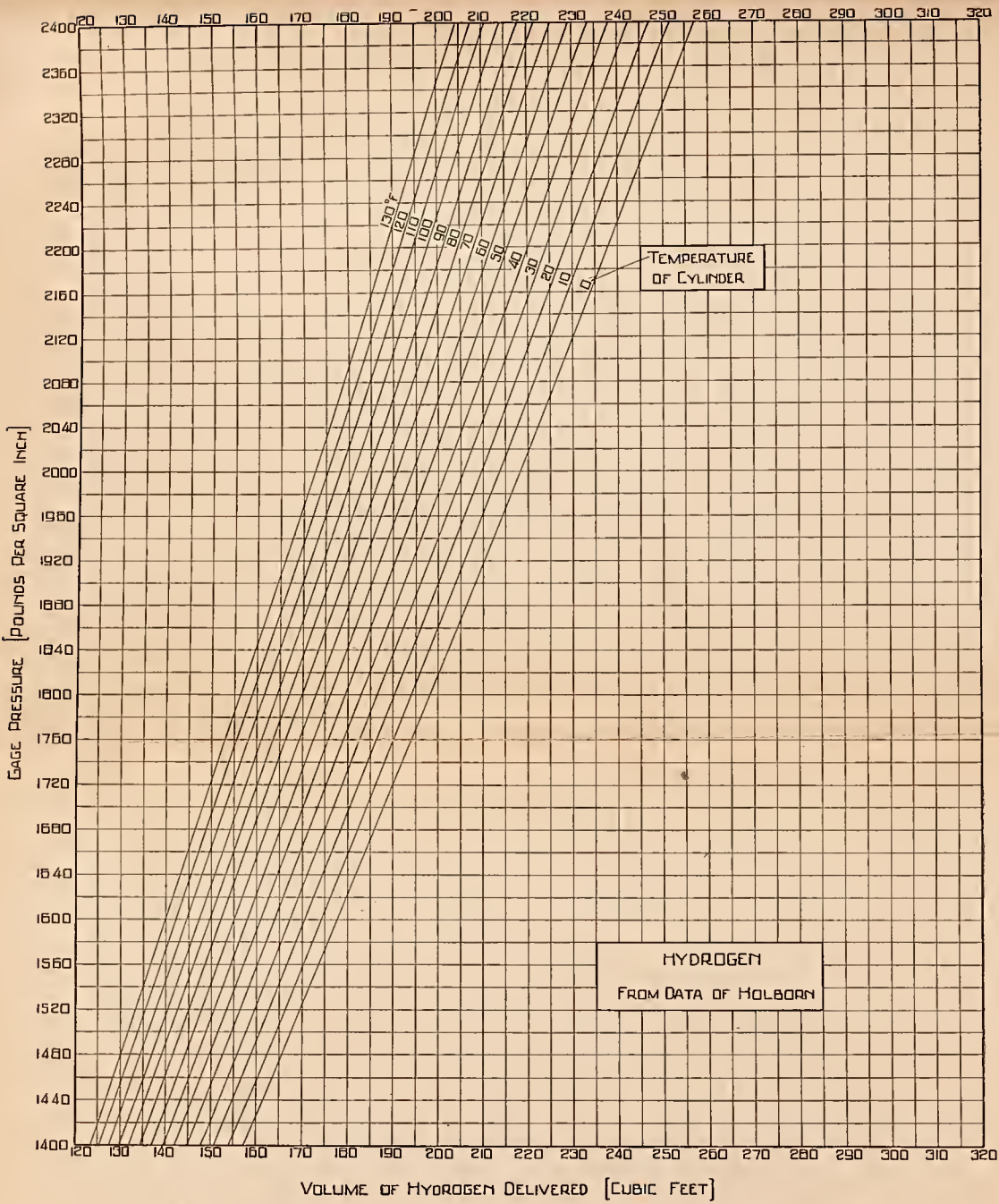


FIG. 11.—*Volume of hydrogen (measured at 1 atmosphere and 68° F.) delivered from a cylinder whose volume is 1.528 cubic feet*

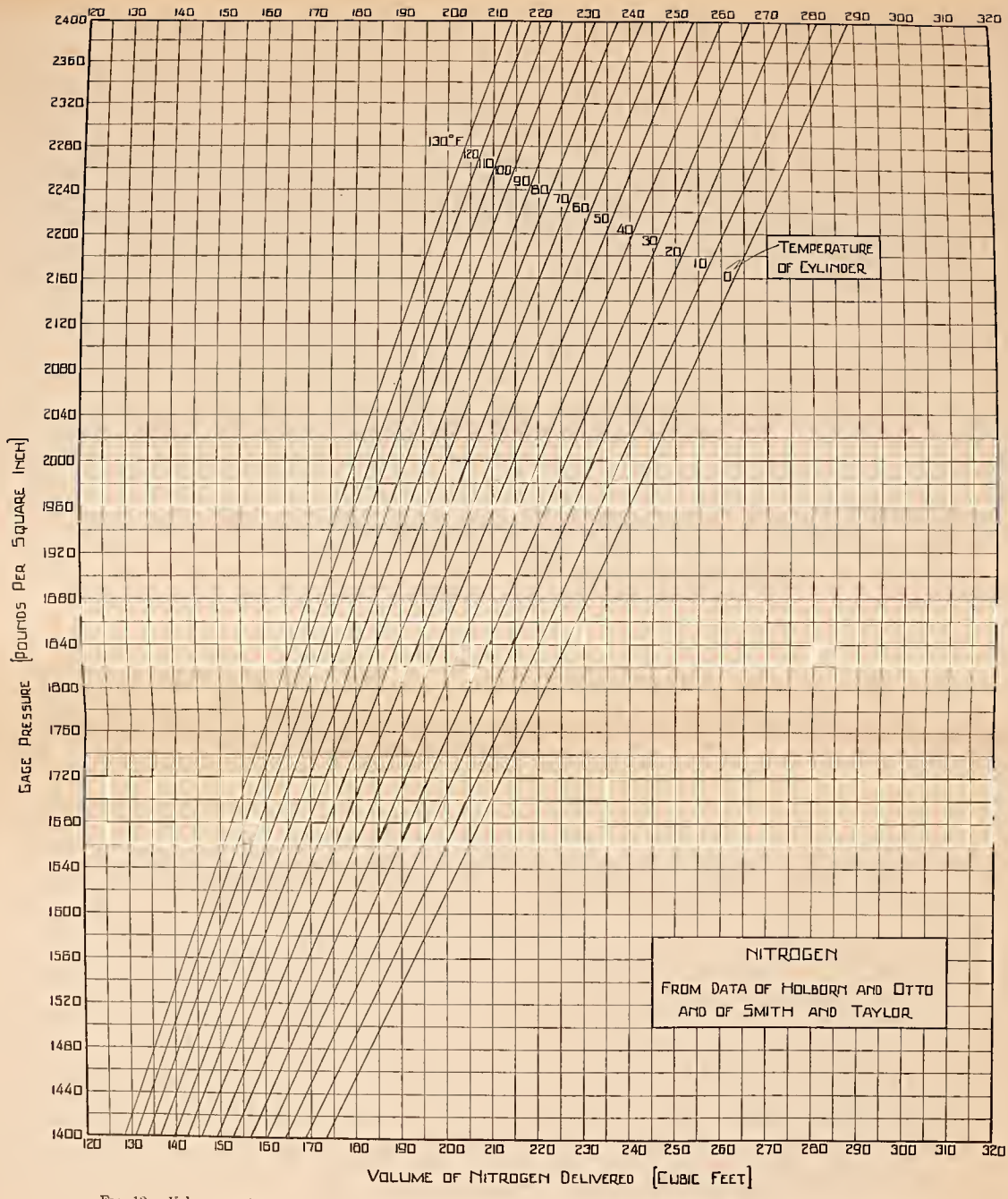
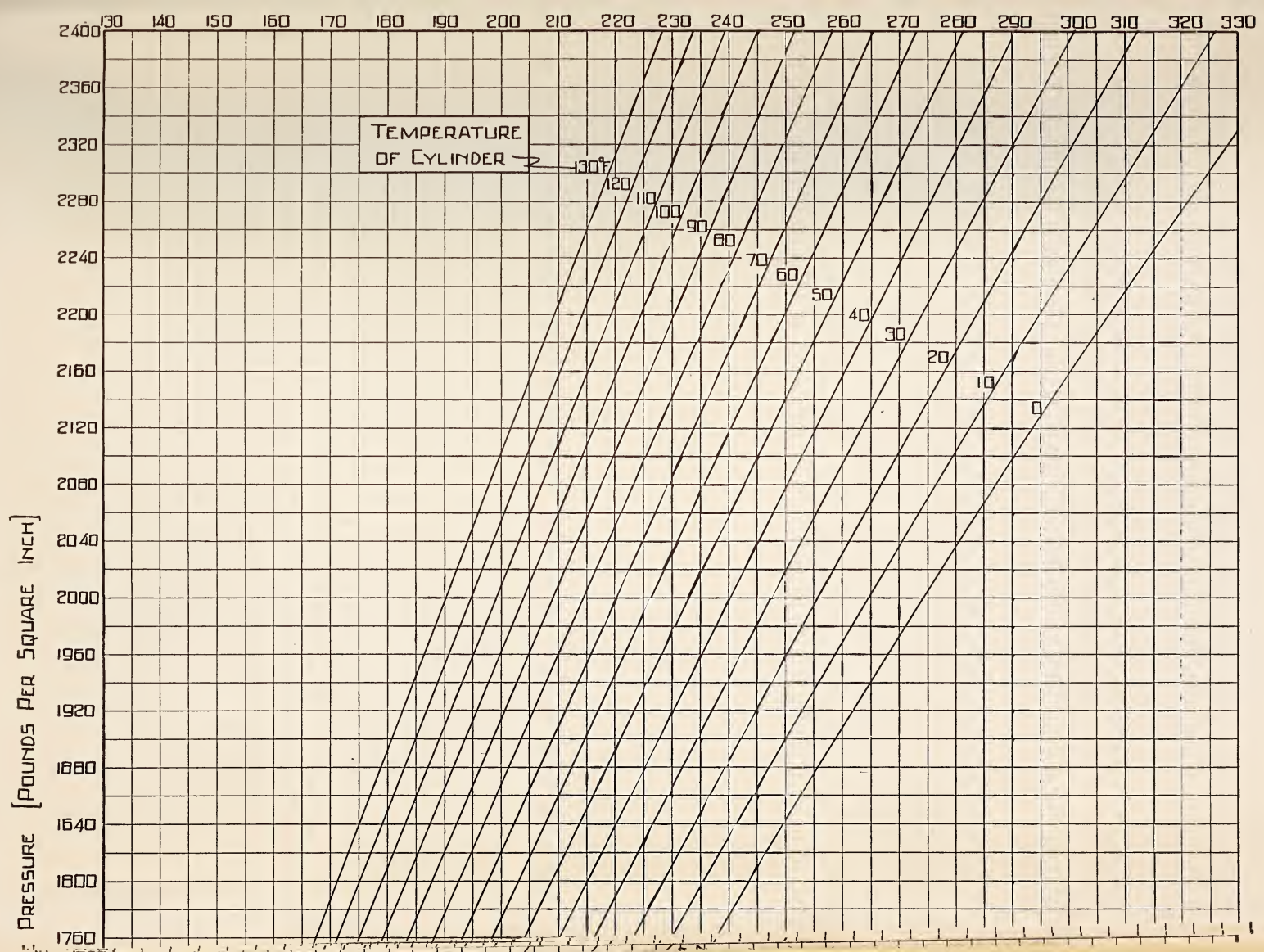


FIG. 12.—*Volume of nitrogen (measured at 1 atmosphere and 68° F.) delivered from a cylinder whose volume is 1.528 cubic feet*


130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330
2400 2360 2320 2280 2240 2200 2160 2120 2080 2040 2000 1960 1920 1880 1840 1800 1760
TEMPERATURE OF CYLINDER
130°F
120
110
100
90
80
70
60
50
40
30
20
10
0
Pressure [Pounds Per Square Inch]

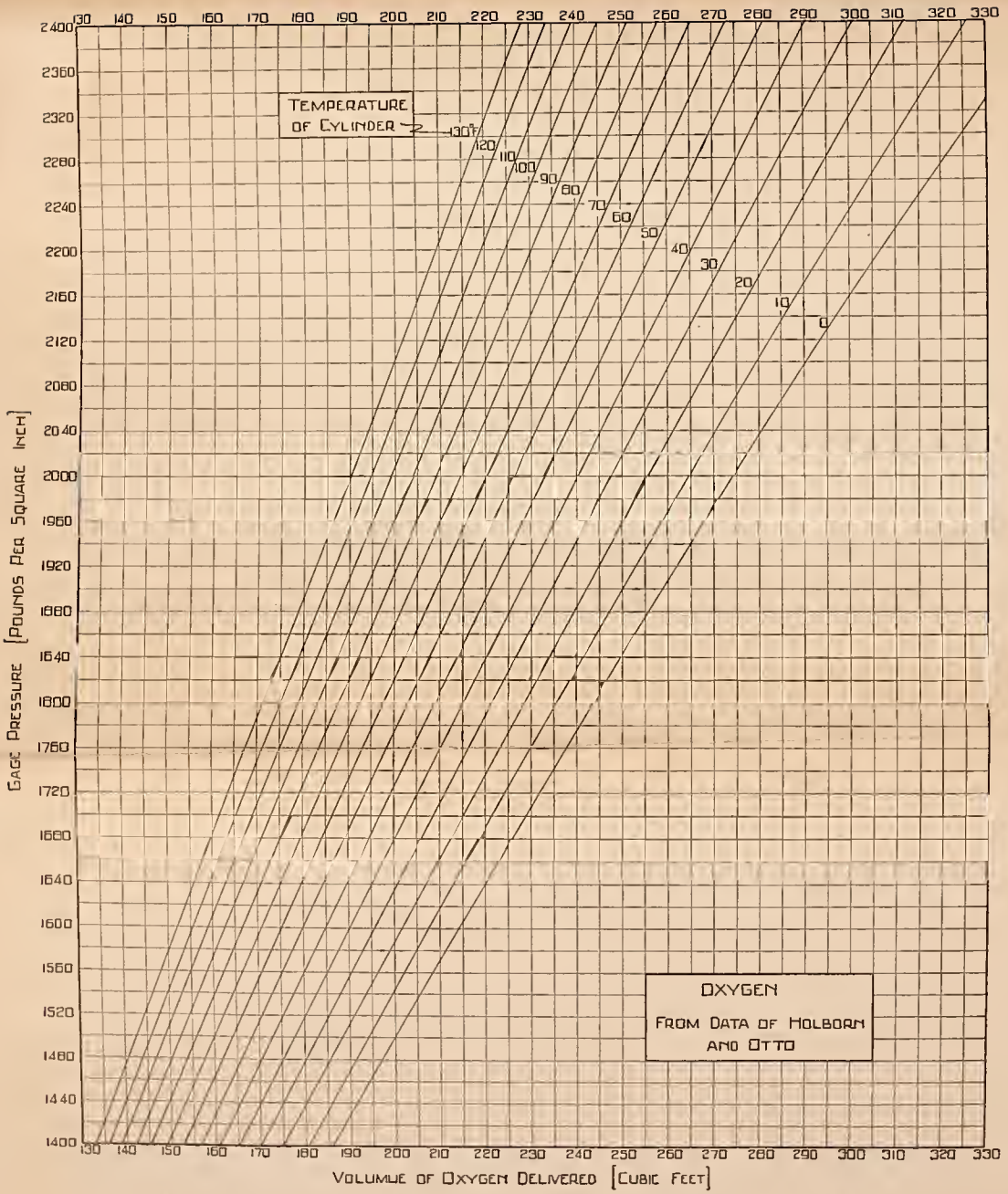


FIG. 13.—*Volume of oxygen (measured at 1 atmosphere and 68° F.) delivered from a cylinder whose volume is 1.528 cubic feet*

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